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Cancer and Sarcoma

A SERIES OF EXPERIMENTS COMPRISING SEVEN YEARS OF RESEARCH WORK, MADE FOR THE PURPOSE OF DETERMINING THE ORIGIN AND CAUSE OF CANCER AND SARCOMA, THEIR METHODS OF PROPAGATION AND MEANS OF PREVENTION.

By H. D. WALKER, M. D.
BUFFALO, NEW YORK

This work was done at my Laboratory at Newburg, New York

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By H. D. WALKER, M. D., Buffalo, N. Y.

(*This work was done at my Laboratory at Newburg, N. Y.*)

THE subject of Cancer and Sarcoma is one of the greatest importance to mankind. Thousands die each year, a lingering, cruel death, from the ravages of these enemies, whose orgin has hitherto been unknown.

It seemed a great undertaking to attempt to wrest from nature this secret, which has so long been sought after by every method which Science and the most learned men could devise. However, in looking about for some subject in Natural History, which I could investigate by the aid of the microscope, I could find nothing which seemed so attractive to me and of greater importance to mankind, than the subject of malignant disease.

In thirty-five years of active practice in Western New York, I have treated many of these cases for which scarcely a hope remained, when the nature of the malady became known. Statistics show that it is increasing rapidly, but, heretofore, we could give no reason for its greater prevalence. I never gave any attention to the manner in which these diseases were contracted, until I took up this investigation, about the 1st of June, 1901.

In reviewing the latest literature on the subject, to which I had access, I was particularly impressed with Behla's observation in the town of Luckau, Germany. This town has a central portion containing about 3,000 inhabitants, with two suburbs, one on the East called Kalau and one on the West, Sando, each having a population of about 1,000, the population of the whole town being about 5,000. In twenty-two and one-half years, from 1875 to 1898, there was not a case of cancer in the Western suburb, Sando. A few cases occurred in the central or main town, and seventy-five deaths from cancer out of a total of 663 deaths from all causes, occurred in Kalau. Cancer therefore caused about one-ninth of the deaths here, and none what-

ever in Sando. We find also that during this time of twenty-two and one-half years, the population and their manner of living continued about the same. The people in each of the suburbs lived on the products of their farms and gardens. The land in Kalau and the main town, was very low, level and damp, while that of Sando was high, dry and sandy. There was a ditch, containing foul stagnant water, which passed closely around a portion of the central town and through the whole of Kalau; all the gardens of which were watered from this ditch, the water of which was used also to wash their garden vegetables. Behla believed that cancer followed this ditch and that the water used from it to wash the vegetables, infected them and many of these which were eaten uncooked, thereby transmitted the germs of cancer to the people who used them.

This observation certainly furnishes *very strong proof* of the parasitic origin of cancer, but it gives no positive evidence that water was the medium through which it was conveyed. Again, in the Cancer Number of the Practitioner for April, 1899, we find two articles, which seem to be especially important for our purpose. One of them is entitled "The Medical Geography of Cancer in England and Wales," by Alfred Haviland; the other "The Local Distribution of Cancer and Cancer Houses," by D'Arcy Powers, F. R. C. S. On reading these over I find it stated that cancer is far more prevalent along rivers, low grounds, and marshy places, than on high dry ground and mountain ranges. If this is a fact, as the investigations of these observers seem to prove, then, it is evident, that the Original Host, if there is one, would be found in greater abundance in such places, and also it must be world-wide, or nearly so in extent, for we know that cancer is common in many different parts of the world.

In view of the absolute failure of all efforts heretofore made to discover the origin and cause of malignant disease, it seemed to me some new method of procedure must be adopted. I therefore determined to take a general survey of the Animal and Vegetable Kingdoms, for the purpose of finding out what animal or plant, found on low moist ground, would be most likely to serve as an Original Host for the supposed parasites. On carefully reviewing the Vegetable Kingdom, I could find nothing which fulfilled these conditions and seemed likely to serve as their Original Host. On looking over the lower forms of animal life, I was strongly impressed with the idea that the earthworm might be the Host. It is well known to naturalists

that earthworms are much more abundant in low moist grounds than on mountain ranges and dry soil. In F. E. Beddard's Monograph on the Oligochæta, or Earthworms, under the head of *Habitat,* he says. "Earthworms are found in almost every part of the world where they have been looked for. They occur far to the North in Siberia and Nova Zembla, while South Georgia and Kerguelen mark their southern limits." Thus we see that two prominent indications are fulfilled by the earthworm. Perhaps this opinion may have been confirmed on account of my previous work on the earthworm, in working out the life history of the *"Gape Worms of Fowls," (Syngamus trachealis), which I found to reside in its embryonic condition, in the intestinal canal of the earthworm, which thus served as a Host for this parasite. In that investigation I found that the earthworm contained many kinds of parasites, some of them in great numbers.

Having determined to investigate anew the parasites of the earthworm, on June 4th, 1901, I procured some of them from the low grounds along the Hudson and commenced my work. I cut one of these earthworms in two, rubbed one of the cut surfaces on a watch glass, and adding a drop of water, stirred well with a needle and placed it under an inch objective. I immediately saw some small bodies, which I had often observed before, and always understood to be the ameboid or white corpuscles of the blood of the earthworm. On examining them under the one quarter inch, their character was more fully brought out, but I wished to examine them more closely. I therefore mounted some of them on a slide in distilled water, and on placing them under a one-tenth immersion, was surprised to find that the breaking down or disintegration into inert matter of these ameboid corpuscles, as it has been described by authors, was a mistake. The result on the contrary, was the formation of a great number of very small bodies, which with a lower power have the appearance of granules, but under a high power objective are seen to be well marked spores or cells, which have a peculiar oscillating motion. A good illustration of these bodies will be found in the last edition of the Micrographic dictionary, plate 38, figures 16 and 17, from cancerous tissue, under the head of granule cells. I found these organisms in the celiac cavity of the earthworm, in various stages of their development.

In the small round forms the nucleus presents a very brilliant appearance and they are found on the bottom of the

*This paper was first published in 1886, in the Bulletin of the Buffalo Society of Natural Sciences, Vol. X, No. 2, afterwards extracted and published in pamphlet form.

watch glass and also floating throughout the liquid. Some of the forms float on the surface and resemble globules of fat, exactly as we find in slides put up from the scrapings of cancerous tissue. * * * We also see them fusing on the bottom of the watch glass and forming irregular ameboid bodies. which contain throughout their structure many small nuclei when viewed under a high power objective. Here indeed was a problem to solve, which demanded careful investigation. I therefore devoted considerable time to looking up the literature of these organisms. They have always been described as body cells of the earthworm, no author having to my knowledge regarded them as parasites.

In Sedgwick and Wilson's General Biology, page 53, we have two figures of these phagocytes. as they are called. It also says: "The celomic fluid is composed of two constituents, viz., a colorless fluid called the plasma, and colorless isolated cells or corpuscles, which float in the plasma, and are remarkable for the fact that they undergo constant though slow changes of form. In fact they closely resemble certain kinds of amebæ, and we should certainly consider them to be such, if we found them occurring free in stagnant water. We know, however, that they live only in the plasma, and have a common origin with the other cells of the body, hence we must regard them not as individual animals, but as constituent cells of the earthworm. The celomic fluid, is in fact a kind of tissue, consisting of colorless isolated cells floating in a fluid intercellular substance. These free floating cells are probably the scavengers (phagocytes) of the body, devouring and destroying waste matters. Some suppose that they also attack invading parasites, such as bacteria." On page 64, same authors, they are referred to as "White blood corpuscles, ameboid cells, lymph cells, and phagocytes," and, "They move their parts much as amebe do, engulphing particles about them by a kind of flux." They have also been called perivisceral corpuscles. In F. E. Beddard's Monograph on the Oligochæta, or Earthworms, these bodies are stated to extend throughout nearly all the Oligochæta, both those which live in the soil and those which live in water. When it is known that over 650 different species of Oligochæta have been described, their extent can be imagined. In some species of earthworms these organisms are of various colors. As before stated I found these bodies corresponded with those we get from the scrapings of a fresh cancer, also the forms we are so familiar with in the illustrations of cancer in the older authors. I endeavored to trace the source of these bodies, and found after

prolonged observation that they derived their origin from the chlorogogue, or chlorogogen cells. In the confirmation of this opinion, Sedgwick and Wilson, on page 61, speaking of the very small particles floating in the celomic fluid, say: "It is nearly certain that these particles are derived from the breaking up of 'Lymphoid' cells, some of which may have been phagocytes floating in the celomic fluid, and the most if not all of these cells are from 'chlorogogue cells' set free from the surface of the blood vessels and of the intestine."

These observations were made on the large earthworm, Lumbricus herculeus, commonly used in biological work. Other species, however, are similar. This matter having been settled to my satisfaction, another problem now presented itself, namely, the nature and origin of this chlorogogue layer which has been described by so many authors. In Huxley and Martin's Biology, page 242, in speaking of the earthworm, it says: "The intestinal wall is invested in a yellowish brown tissue of so-called 'chlorogogen cells.' This tissue (originally thought to have been a kind of liver) has no sort of connection with the lumen of the gut; it is intimately associated with the walls of the great blood vessels, many of which it completely surrounds, and there is reason for regarding it as functional, in the formation of an excretory product, which is discharged into the body cavity, if not in that of some constituent of the blood also." On page 267, in speaking of this layer, it says: "Its component cells are elongated and club-shaped, each containing a single oval nucleus and crowded with minute highly refractive globules." In Sedgwick and Wilson, page 52, we find the following description: "The outer surface of the stomach intestine is covered with pigmented, yellowish brown, 'chlorogogue cells.' These were formerly supposed to be concerned with the secretion of the digestive fluid and hence are often called 'hepatic cells.' This, however, is probably an erroneous interpretation, and they are now believed to be concerned with the process of excretion." By the process of excretion, we suppose is meant the throwing off of those very small particles, which they regarded as inert matter.

In F. E. Beddard, on the Oligochæta, in Vol. II, the Cambridge Natural History, "Worms Rotifers and Polyzoa," 1901, page 355, under the head of Celom and vascular system, the author says: "When an earthworm is dissected the various organs are seen to lie in a fairly spacious cavity, which is interrupted and divided into a series of chambers by the mesenteries, or septa, which stretch across from wall to wall of the

body, and correspond roughly in their position to the groves which separate the body externally. This cavity common to all the higher animals, is known as the celom. It is lined by cells which cover the intestines as well as the inside of the body wall, and upon the intestine assume the form so characteristic of the group, namely, that of large yellow cells loaded with secreted matter and called chlorogogen cells by Claparede."

In Gould's Dictionary of New Medical Terms, 1905, we find that chlorogogen is derived from two Greek words, χλωρός greenish, and αγωγη a carrying off. It is defined as follows: "Applied to peculiar peritoneal cells, with definite excretory functions. They are especially strongly developed in the Oligochæta, but occur also in the Polychæta. They are attached to the dorsal vessel and its branches, and contain brown granules taken from the blood." In looking over the Polychæta, which are marine worms, we find thirty-four families, comprising hundreds of species described. We also find that the most of them contain celomic corpuscles and chlorogogen cells, like their near relative the earthworm. When it is known, as we hope to satisfactorily prove later, that these celomic corpuscles and chlorogogen cells are different stages in the life history of parasitic protozoa, heretofore unknown, belonging, some of them at least, and perhaps all, to the sporozoa, we see what a vast field we have before us for investigation.

From our observation, it also seems quite probable, that each species of worm harbors a different species of parasite. In order to find out whether these bodies are the parasites which cause Cancer and Sarcoma, as I strongly suspected, I determined to feed them to animals and see if they could be infected thereby. I therefore procured two guinea pigs, one to be used as a control, placed them in separate cages, and giving each hay, oats and water, commenced my experiments.

EXPERIMENT No. 1

A large guinea pig, No. 1, on June 14th, 1901, at 9:45 A. M., was fed a thick, slimy liquid, prepared by cutting a large earthworm (Lumbricus herculeus) into many pieces, with distilled water in a glass dish. This worm was washed in water before being cut up. The liquid was well stirred and a drop being placed under the microscope showed a great number of these bodies, which I believed to be the spores and cells of a parasite in the different stages of its development. A small rubber tube

was passed into the pig's throat and a glass syringe being inserted into its outer extremity, about two drams of the liquid was injected, the greater part of which was retained.

This method was adopted (instead of injecting under the skin as is usually done), in order to closely follow Nature, for I believed the natural way in which cancer usually gained access to the body, if it was a parasite, was through the digestive system.

June 18th. 9:45 A. M., pig evidently sick. Breathes irregular and rapid and often shivers, curls up in a corner of his cage and eats very little. The control well and lively. June 19th, morning, pig evidently worse. 1 P. M., abdomen bloated and very tender when pressed. Stools thin and found under the microscope to be composed almost entirely of the organisms from the earthworm. Some of these were put up in a slide with a little distilled water, in which they lived until the slide was broken, over three years. During that period they could be seen to move, and they increased greatly in number. Pig quite sick for several days, remaining most of the time curled up in a corner of his cage and eating very little. June 25th, pig some better, runs about and eats more. July 1st, about the same for the past few days. July 5th, pig eats very little now, and is getting quite poor. Abdomen very tender and he now keeps quiet most of the time. Pig No. 2, the control, well, eats heartily and no bloating or tenderness of the abdomen when handled quite roughly.

On July 5th I took a drop of blood from the ear of pig No. 1, and put it up in a slide with a little distilled water. On examining this under the microscope, I found it to contain many of the same organisms which he was fed from the earthworm, in different states of development, the smaller forms being quite abundant. Pig continued to grow thinner and to eat less, and died on the morning of July 15th, thirty-one days from the time he was fed the organisms from the earthworm.

On opening his abdomen, the intestines were found reddened and congested in many places. The lungs had patches of infiltration, and on scraping some of its freshly cut tissue, an abundance of bodies like those from the earthworm were found. Sections of the lungs showed many small nodules, which were variously interpreted by different pathologists.

One said at first he could not deny but what it was Cancer, another called them epitheloid cells, another lymphoid cells, and still another endothelioma. On July 6th I noticed that pig No. 2,

the control, was not well, seemed to have similar symptoms to the one that died. I had not fed him any of the organisms, but he evidently was quite sick. His cage was within a few feet of the other, and on the evening of June 29th I found that pig No. 1 had escaped through a loosened slat and was perched upon the top of the cage of the control, where from appearances he had been for some time. Pig No. 2 continued to grow worse and died on the night of July 16th. Before he died I examined a drop of blood from his ear and found the same kind of organisms in it I found in Pig No. 1. I believe he was infected by the excrements of No. 1, which contained the parasites, dropping through on to the hay in his cage. This pig lived 17 days, from the time of his supposed infection. He was much smaller than No. 1, and I have since found that young pigs die quicker when fed the organisms, than those which are older. On repeated examinations I have never found these organisms in the blood of the normal guinea pig, nor in one which I kept afterwards for a long time as a control, under the same conditions.

On examining this pig I found the same lesions present in the abdomen and lungs as in the first pig. Sections of the lungs also showed the same kind of nodules, only less in size, than in No. 1.

EXPERIMENT No. 2

On August 12th, 1901, I fed a good sized pig, No. 3, in the same manner as before, about two drams of a liquid obtained from six small earthworms, by placing them one at a time in a Syracuse watch glass, with a little water and gently pricking themwith a needle, not hard enough to penetrate the skin. These worms were first carefully washed in water to remove any organisms which might adhere to them externally. I found when irritated with a needle, they throw out through the orifices of the skin a thick slimy liquid containing an abundance of the organisms on which I was at work. These organisms were also found to be thrown off when crawling over a watch glass, or any other object; and I made this test to determine whether there would be enough to cause the infection and death of the pig.

The importance of this experiment will readily be seen, for earthworms are very fond of various kinds of vegetables, such as cabbage, celery, lettuce, onions, etc., according to Darwin in his last work, "The Formation of Vegetable Mould Through the Action of Earthworms."

F. E. Beddard, in "Worms, Rotifers and Polyzoa," on page 355, says: "But worms are epicures and exhibit a decided taste and preference for certain articles of diet. Like their fellow-tiller of the soil, the agricultural laborer, worms have a keen relish for onions, which, however, they must recognize by the smell. They prefer green cabbage to red, celery to both, and raw meat appears to be the greatest delicacy that can be offered to them."

From the foregoing observation it is seen that in crawling over and feeding on the leaves of vegetables, earthworms would leave these organisms on their surface. In due time Pig No. 3 became sick, having the same symptoms as the others. On September 3rd, twenty-two days from the feeding, I examined a drop of blood from his ear and found it contained the same organisms I fed him. He died September 6th, at 4 P. M., twenty-five days and five hours from the time he was fed. On examination the same lesions in the abdomen and lungs, accompanied by the organisms were found as in the other pigs.

EXPERIMENTS No. 3 and No. 4

On August 30th, at 1 P. M., fed pigs 4 and 5 in the same manner as before, one dram of a solution made by cutting up into small pieces in a glass dish with water, three earthworms, about two and one-half inches in length. Pig No. 5 rejected about half the amount he was fed. None of the body of the earthworms in this or any of the previous experiments was injected, and they were always washed well in water before being used, to remove all portions of earth which might contain other toxic organisms.

These pigs developed the same symptoms as the others. Pig No. 4 died at 1 P. M., September 17th, just eighteen days from the time of his feeding. Pig No. 5 died at 9 A. M., September 20th. He retained only about half the organisms fed, consequently lived longer, namely, twenty-one days less four hours, nearly three days longer than pig No. 4. These pigs were the same age and doubtless would have died about the same time had each retained an equal amount of the organisms. The same lesions were found in the abdomen and lungs, and the same organisms in the blood as before.

EXPERIMENTS No. 5 and No. 6

August 31st, 10 A. M., fed pigs 6 and 7 each one dram of a similar mixture as before. These pigs were affected like the

others. Blood taken from their ears a few hours before they died showed the organisms as before. Pig No. 6 died September 18th, 10 A. M., eighteen days from the feeding. Pig No. 7 died during the night of September 17th, a few hours less than eighteen days. Examination after death showed the same lesions found in the other pigs.

EXPERIMENTS No. 7 and No. 8

On September 3rd, at 4 P. M., fed pigs 8 and 9 each one dram of a solution made as before. Both showed the same symptoms as the others. On September 19th, I examined blood from the ear of pig No. 8 and found plenty of the organisms. He died that night, living between sixteen and seventeen days, from the time he was fed. On September 21st pig No. 9 died, eighteen days after the feeding. Blood from his ear was examined and five slides put up in the forenoon of September 21st, in all of which there was an abundance of the cells. The same condition in the lungs and abdomen was found as in the other pigs.

EXPERIMENT No. 9

On December 18th at 10 A. M., fed a good sized pig No. 10, the parasites of an earthworm of the species Allolobophora fœtida, procured from upper Main Street, Buffalo, during the month of November. The worm was prepared as before. This pig commenced to be sick five days after the feeding. His symptoms were like many of the other pigs, namely, a well-marked chill, the animal is seen to shiver, loss of appetite and frequently opening his mouth as though tasting something. December 31st, put up a drop of blood from his ear, in which I found plenty of the organisms. Pig died January 3rd, 1902, at 10 A. M., sixteen days from the feeding. Same lesions found as in the others.

EXPERIMENT No. 10

On December 18th, fed a small pig, No. 11, during the day a handful of grass procured on December 10th from a sandy spot of ground in which earthworms were very plentiful. There were only a few scattered tufts of grass growing here, and these I found to contain what I believed to be the organisms from the earthworm. This test was made to determine if such was the case, and if so, if they were in sufficient quantity to kill the

pig. This grass was well dried, hay, in fact, when fed, eight days after being picked. Pig became sick the fifth day after the feeding. On the sixth day he had a severe chill. He shook so that his teeth could be plainly heard to chatter. He died on the morning of December 25th, seven days from the feeding. Examination showed the same organisms in his blood and lungs as were found in the others, and in the hay which he was fed.

EXPERIMENT No. 11

On December 20th, at 2 P. M., fed a medium sized pig No. 12, the organisms from a small sized earthworm, species Allobophora fœtida, from upper Main Street, Buffalo. This pig had the first symptoms of infection on the night of December 25th, five days from the feeding, and died on the morning of the 31st, 10 A. M., living eleven days less four hours from the time he was fed. Same lesions found as in the others.

EXPERIMENT No. 12

On December 20th, fed a Belgian hare, No. 1, two months old, the organisms from a medium sized earthworm, species Allolobophora fœtida, from Buffalo, the same way as before, January 10th, 1902, hare shows first signs of infection, by loss of appetite and remaining curled up in a corner of his cage. January 11th, refuses to eat or drink. After a day or two commenced to get better, and continued about in his normal condition until he was killed January 29th, forty days from the time he was fed. The same organisms were found, especially in the lungs, as in the pigs.

During February, March and April I examined several species of earthworms in the Southern States, and found they all contained the organisms, but they seemed to differ from each other slightly, in each species of worm. This difference was in regard to their size, shape and mode of grouping themselves together. It seemed to me quite probable that each species might produce a different variety of malignant disease.

I therefore determined in my future experiments, in all cases to note the species of earthworm from which the organisms were derived, and see if the results were different. In the summer of 1902, I renewed my experiments.

EXPERIMENT No. 13

On May 18th, at 12 M., fed a good sized pig, No. 13, the organisms from an earthworm of the species A. foetida from

Newburgh, in the same manner as before. June 9th, examined the blood from his ear and found the organisms. Pig died the same day at 2 P. M., twenty-two days after being fed. Sections were made and the parasites found in them as before.

EXPERIMENT No. 14

On May 18th, fed a medium sized pig, No. 14, the organisms from an earthworm, species A. fœtida, from Newburgh. This pig had the same symptoms as the others and died June 2nd, fifteen days after being fed. Examination both before and after death showed the usual organisms.

EXPERIMENT No. 15

On May 18th, at 12:30 P. M., I injected under the skin of the back of pig No. 15, a solution the same as fed the others, from an earthworm of the species A. fœtida. This pig died on the night of June 3rd, sixteen and one-half days after the injection of the organisms. On examination I did not find the abdominal viscera congested as in the previous cases, which were fed by the mouth. The lungs, however, were full of the parasites.

EXPERIMENT No. 16

On May 19th I fed pig No. 16 the organisms from a small earthworm, species A. fœtida, from Washington, D. C. Same symptoms as before, and pig died June 3rd, fifteen days from the feeding, and the same parasites found on examination.

EXPERIMENT No. 17

On October 16th, 1902, I fed a small dog which had the appearance of being several years old, a medium sized Lumbricus herculeus, cutting it up in very small pieces in a little water and mixing it thoroughly with his food. On December 10 I fed this dog another worm of the same species in the same way. December 15th dog's abdomen very tender on pressure, and he has little appetite. Has the appearance of being infected. I fed him another worm as before on December 20th, 25th and 30th. I repeated the feeding on January 4th and January 30th, 1903. On February 12th, fed dog an earthworm of the same species which had been dried and wrapped in paper over one year. This worm was broken in small pieces, well soaked in water and then the pieces mashed so that the parasites might become active. I

would here state that these organisms are not killed by drying or freezing, for when a piece of worm which has been dried several months, or has been frozen, is well broken up in water, the organisms resume their activity the same as in a fresh worm. March 2nd, gave dog a hypodermic injection under the skin of the back, of the same species prepared by cutting it up in water. On May 8th I killed this dog, 204 days from the beginning of the experiment. There was no tumor where the hypodermic was given, nor could I discover any on examination of the body. Many of the parasites were found in different organs.

EXPERIMENT No. 18

On October 16th, 1902, I fed a medium sized young dog an earthworm of the species Allolobophora profuga, in the same manner as the first dog was fed. On December 10th and 15th fed two earthworms at each feeding. December 30th, fed eight earthworms. January 4th, 1903, dog's abdomen quite tender on pressure. Fed eight earthworms and repeated the feeding on January 30th. March 2nd, gave dog an hypodermic injection of the organisms in water under the skin of the back. On May 9th I killed this dog, 205 days from the time of the first feeding. There was no tumor found where the injection was made, nor in the internal organs. Many of the parasites were found throughout the animal.

EXPERIMENT No. 19

On October 16th, 1902, I fed as before a small young dog, two worms of the species A. fœtida. On December 10th and 15th, I fed two worms at each feeding. December 30th and January 4th, 1903, fed eight worms at each feeding. On December 30th, I found dog's abdomen very tender on pressure. On March 2nd I injected under the skin of the back, one-half dram of a mixture of the parasites made by cutting up two worms A. fœtida, in a little water. On May 6th I killed this dog, 202 days from the time he was first fed. The internal organs contained no tumors. There was a nodule under the skin where the injection was made, sixty-five days before. When sections were made from the nodule, well marked Plimmer's bodies were found. The lungs and spleen also contained them.

EXPERIMENT No. 20

On October 19th, 1902, I fed a Belgian hare, No. 2, about four months old, the organisms from a fair sized L. herculeus, by

injecting them down his throat with a glass syringe and rubber tube as in previous cases. November 6th, hare has symptoms of infection, bloating and tenderness of abdomen. December 11th, fed hare the parasites from another worm of the same species. December 17th hare shows well-marked signs of second infection. December 23rd, hare died today, sixty-six days from the first feeding and twelve days from the last. Sections of the liver showed well marked Sarcoma.

EXPERIMENT No. 21

On October 19th, 1902, I fed a Belgian hare, No. 3, the organisms from a fair-sized earthworm, of the species Allolobophora profuga, in the usual way. November 6th, hare has symptoms of infection. December 11th, fed organisms from two worms of the same species. December 17th hare has symptoms of second infection. January 10th, 1903, abdomen bloated and liver plainly enlarged. Fed organisms from two worms of the same species. January 31st, fed hare four worms (A. profuga) by cutting them up in a little water and mixing them with oats in a dish. The mixture was well stirred and the hare ate them all. February 14th, the hare died today, 119 days from the first feeding and fourteen after the last. A well marked tumor in the stomach, which is believed to be Sarcoma, was found. The parasites were also seen in sections of the lungs, liver and spleen.

EXPERIMENT No. 22

On October 18th, 1902, I fed a Belgian hare, No. 4, the organisms in the usual way, from two earthworms of the species A. fœtida. November 6th hare is infected. December 11th repeated the feeding of two worms, also on January 10th, 1903. March 3rd killed the hare. No tumors discovered, but the parasites were found in sections of various organs.

EXPERIMENT No. 23

On March 28th, 1903, I fed a guinea pig, No. 17, the parasites from an earthworm, L. herculeus. On April 13th, sixteen days from the feeding, this pig died, and the parasites were found throughout the lungs, liver and spleen.

EXPERIMENT No. 24

On March 28th, at 4 P. M., I injected the parasites from an earthworm, species A. fœtida, under the skin of the back of pig

No. 18. April 5th, pig died last night, about seven and one-half days after the time of the injection. Found the parasites through the organs as usual.

EXPERIMENT No. 25

On March 28th, I injected the parasites from an earthworm, A. fœtida, under the skin of the back of pig No. 19. This pig died April 19th, twenty-two days from the injection. No tumors were found, but an abundance of the parasites through the different organs.

On September 11th, 1903, I procured six guinea pigs, and believing that the previous ones had died too soon for the production of well marked tumors, I thought if I could prolong their life, I might be able to succeed in producing them. I therefore determined to feed them fresh grass once daily, at noon, and hay and oats morning and night, and note the effect.

EXPERIMENT No. 26

On September 11th, I fed two pigs, Nos. 20 and 21, in the usual way. No. 20 was fed the parasites from a large L. herculeus, and No. 21 those from two medium sized worms of the same species. Every day at noon each one was fed a good handful of green grass in place of hay. After five or six days they had slight symptoms of infection, but these soon passed off and they seemed to be entirely well during the remainder of the time the grass was fed, and six weeks from the beginning of the experiment. On October 23rd, I fed these pigs in the usual way, each the parasites from a large L. herculeus; I also discontinued feeding the grass, giving them hay instead. On December 6th, forty-four days from the last feeding, I killed pig No. 21. On December 7th, forty-five days from the last feeding, I killed pig No. 20. On careful examination I could find no tumors in either of them.

EXPERIMENT No. 27

On September 11th, I fed two pigs, Nos. 22 and 23, each the parasites from two earthworms, species A. profuga, as before, giving them a handful of grass at noon. After five or six days they showed a slight infection, but soon recovered, and after six weeks seemed quite well. On October 23rd, I fed each of the pigs, the parasites from two A. profuga, and the feeding of grass was omitted. November 27th, pig No. 23

died, twenty-four days from the last feeding. December 7th, killed pig No. 22, forty-five days from the last feeding. No tumors in either of these pigs were found.

EXPERIMENT No. 28

On September 11th, I fed two pigs, Nos. 24 and 25, each the parasites in the usual way from four A. fœtidœ. These pigs, like the previous four, besides their hay and oats, were fed a handful of grass once daily. After a few days like the others they manifested slight symptoms of infection, which soon passed off, and they remained well six weeks after. On October 23rd, they were each fed the parasites from eight A. fœtida, hay and oats being fed as usual without the grass. On December 6th, forty-four days from the last feeding I killed these pigs. No tumors were found. In all six pigs the parasites were found in their blood, both in the ameboid and round forms. They were also found in sections of the different organs. On November 18th I put up a slide of blood from pig No. 25, which contained plenty of the parasites. These three experiments seems to me of much importance, from the fact demonstrated, that when pigs are fed green grass once daily, the parasites failed to kill them, and they only manifested slight symptoms of infection, which soon passed off. Not only this but they were rendered nearly immune to the further action of the parasites for several weeks, by this means of feeding them.

Compare this with *Experiment No.* 10, in which a pig fed dried grass containing these parasites died in seven days. Further experiment along this line should be made to determine the reason for this protection and immunity. At first I thought the parasites entered into the green vegetable matter and passed out from the animals, but the well marked production of immunity shows something beyond that. Have we in green vegetable matter a preventive or remedy for malignant disease? Perhaps persons eating green vegetables containing the parasites are protected to a considerable extent in the same way. During the summer of 1904 I experimented with several other guinea pigs, but as nothing further was developed it is unnecessary to give the details.

EXPERIMENT No. 29

On August 14th. 1905, I injected into the peritoneal cavity of a Belgian hare, No. five, three months old, an hypodermic syringe full of the parasites from an earthworm, L. herculeus, cut

up in water. September 8th, hare quite sick. Eats and drinks very little, and coughs considerably for the last few days. Abdomen bloated. September 15th, hare died last night, thirty-one days after the injection. I removed the lungs, liver, stomach, spleen and kidneys. I found the pylorus contracted and the stomach greatly enlarged, and its walls thickened. The spleen was enlarged and filled with white nodules, a number of which were found in the liver. Sections from the lungs, liver, spleen and pylorus contained round and spindle cells of Sarcoma. Sections of the liver were pronounced by two pathologists adeno-Sarcoma.

EXPERIMENT No. 30

On August 15th, 1905, I injected into the abdominal cavity of hare No. 6, three months old, the parasites from two small earthworms (species not identified). November 25th, repeated the injection, using six worms of the same species. No symptoms of infection noted. February 25th, 1906, I injected under the skin of the back, two syringes full of organisms from four A. fœtidæ. May 6th, repeated the injection of parasites from A. fœtida, as before. July 1st, injected organisms from five A. fœtidæ, down hare's throat. July 15th, repeated feeding as above. August 12th injected into the abdominal cavity, one syringe full of organisms from several A. fœtidæ, cut up in water. No infection followed. This hare seems to be immune, either naturally, or he has been rendered so by the continued use of the parasites., On September 9th, I injected two syringes full, made from several A. foetidae cut up in water, into the abdominal cavity. The second day after this injection, hare commenced to be sick. Abdomen distended and very tender, and for eight or nine days ate nothing. Became very poor and looked as if he would die from peritonitis. After about nine days he commenced to eat and get better. About a week after this, I discovered a small nodular tumor on the peritoneum, which grew until it was an inch in diameter. Then an opening formed through the peritoneum, in the middle of the tumor, which opening gradually increased in size as the tumor disappeared. The edge of the opening was composed of many small nodules and had the feeling of a malignant tumor. These nodules gradually disappeared leaving a smooth edge, through which the intestines protruded and the hare seemed in a normal condition, except the hernia.

The opening in the peritoneum gradually grew less and in a few weeks the hernia disappeared. December 16th, fed hare

the organisms from several A. fœtidæ cut up in water and mixed with his oats. No effect noted. On March 10th, 1907, injected two syringes full of material from A. fœtidæ into abdomen. No symptoms of infection discovered. October 13th, hare died today. Found no tumors, but extensive adhesions of the abdominal organs. The liver and spleen were both atrophied. Sections of different organs showed many Plimmer's bodies and cancer cells.

EXPERIMENT No. 31

On August 16th, 1905, I injected into the peritoneal cavity of hare No. 7, the parasites from two earthworms, of the species A. profuga. November 25th, injected in the same manner, the parasites from six A. profugæ. The animal had symptoms of infection each time, but soon recovered. Thinking the hare could not be killed with these parasites, I resolved to try those from A. fœtidæ. Therefore on February 23rd, 1906, I injected under the skin of the back, the parasites from four A. foetidae. This not having the desired effect, on May 6th, I injected into the peritoneal cavity the parasites from four A. foetidae. May 8th, hare died today, forty-eight hours after last injection. Had peritonitis. Sections from the lungs, spleen and stomach, showed plenty of parasites. Both species were present. Great number of Plimmer's bodies were found.

EXPERIMENT No. 32

On August 17th, I injected into the peritoneum of hare No. 8. the parasites from two A. fœtidæ. November 25th, injected in the same manner the parasites from six A. foetidæ. November 30th, hare died last night, four and one-half days after the last injection and 104 days from the first. On examination find well marked peritonitis. Sections of the organs showed the parasites of Carcinoma. The spleen especially had them in great numbers.

EXPERIMENT No. 33

On June 5th, 1905, I prepared a culture of the organisms from L. herculeus by cutting up a worm of this species in a little water and smearing this over the under side of a cabbage leaf growing in the garden. This method was adopted to closely imitate nature, for we know it is a habit of earthworms when feeding on plants to attack the under surface of the leaf where the stomata of the plant open. In the beginning of this paper

I proved that these parasites of the earthworm passed through the orifices of their skin when they crawled over the surface of any object. Now I wished to see if I could produce a culture in the plant sufficient to infect an animal. The leaf was left on the plant until July 10th, when it was removed, carefully washed and cut up finely in distilled water, when the parasites in large numbers came out as shown by placing a drop of the liquid under the microscope. They were kept in a test tube plugged with cotton until used. They were in the plant thirty-five days and in water in a test tube thirty-eight days. On August 17th, seventy-three days from the time they were removed from the worm an hypodermic syringe full of this culture was injected into the peritoneal cavity of hare No. 9, four weeks old.

September 7th, hare not well, seems to be growing poor. October 1st, very poor and weak, looks as though he would die very soon. Infection has certainly taken place. November 1st, hare much better now. November 25th, hare now seems to have completely recovered from the infection, and I injected through the peritoneum, the parasites from a fair sized L. herculeus. January 31st, 1906, hare died last night, 166 days from the first injection, and sixty-seven days from the last. On examination I found necrosis of the intestine, commencing about eight inches below the stomach, and extending downward five or six inches. The intestine was very dark colored and sections showed the parasites in its structure. The stomach was greatly dilated. The parasites were also found in sections of the lungs, liver and spleen.

EXPERIMENT No. 34

On October 1st, I injected into the peritoneal cavity of hare No. 10, four and one-half months old, the parasites from two A. fœtidæ. October 5th, abdomen bloated and very tender on pressure. After a few days this passed off. November 25th, injected the parasites from six A. fœtidæ into the peritoneal cavity. December 7th, hare died last night, twelve days after th last injection, and sixty-seven days after the first. On examination I find no tumor, but plenty of the parasites of carcinoma in sections of the liver, spleen, stomach and intestines. There were many Plimmer's bodies in various stages of development.

EXPERIMENT No. 35

On October 1st, 1905, I injected into the abdominal cavity of hare No. 11, four and one-half months old, the parasites

from two A. fœtidæ. October 5th, hare's abdomen bloated and very tender on pressure. November 25th, injected organisms from three A. fœtidæ, into the abdomen. December 7th, I discovered a bi-lobed tumor, under the skin of the abdomen, below the left foreleg. December 22nd, tumor growing quite fast. It is now about one and one-fourth inches long and three-fourths of an inch wide, distinctly bi-lobed and adherent to peritoneum. December 25th hare has quite a cough tonight. Perhaps parasites are invading lungs. January 8th, 1906, killed hare this morning, and find the tumor situated on the left side of the abdomen, about half-way between the fore and hind legs. It is a tumor of the peritoneum, starting from its internal surface, its has grown through and projects on the external surface next the skin which is not involved in the growth. The original two lobes have coalesced. The tumor is solid and white and measures one and one-fourth inches in length by three-fourths of an inch in width, and the same in thickness. I removed the lungs liver, spleen, kidneys and several nodules in the abdomen. There is metastasis to the liver, several small white nodules being found on its surface which on section proved to be Cancer. Sections from the tumor were sent to a well-known pathologist, who pronounced it Carcinoma. The lungs, liver and spleen, contained the parasites in abundance. Plenty of Plimmer's bodies in different stages of growth were found.

EXPERIMENT No. 36

On December 24th, 1905, I injected into the peritoneal cavity of hare No. 12, four weeks old, the parasites from one A. fœtida. March 4th, 1906, injected under the skin the parasites from two A. fœtidæ. July 1st, fed hare the parasites from four A. fœtidæ. July 15th, repeated the feeding of four A. fœtidæ. July 24th, hare getting very poor and weak, and I killed him. Found no tumors, but sections of the lungs, liver and spleen plainly showed the parasites of Carcinoma.

EXPERIMENT No. 37

On December 20th, 1905, I injected into the peritoneal cavity of hare No. 13, four weeks old, the parasites from one A. fœtida. February 16th, 1906, hare died this morning. He was very poor and weak before he died fifty-four days after the injection. No tumors found, but sections of different organs showed the parasites of Carcinoma.

EXPERIMENT No. 38

On January 14th, 1906, I injected into the peritoneal cavity of hare No. 14, six weeks old, the parasites from two A. fœtidæ. March 4th I injected under the skin the parasites from two A. fœtidæ. July 1st, fed hare the parasites from four A. fœtidæ. August 12th injected under the skin a syringeful of parasites from several A. fœtidæ. Hare died August 22nd, 220 days from first, and ten days after last injection. No tumors found, but sections of lungs, liver, stomach and spleen, showed the parasites of Carcinoma.

EXPERIMENTS WITH WHITE MICE

Procured twenty-four white mice and placed them in four cages, six in each cage. I fed these mice oats and bread and gave them milk to drink.

EXPERIMENT No. 39

On August 12th, 1906, I injected under the skin of the back in front of the tail of six mice in cage No. 1, a few drops of a liquid made by cutting up three A. foetidae, in a small quantity of water. August 13th, one of the mice died. He was probably injured in giving him the injection. September 9th, repeated the injection in the remaining five mice. September 10th, found two of the mice dead. No tumors discovered, but the parasites were found in sections of lungs and spleen. October 14th, two of the mice show well marked signs of infection. One has a small tumor near the site of injection, and the other has one of the hind legs anchylosed at the hip joint, and drawn up, with the loss of hair over considerable of its surface. On November 28th, I fed the mice the parasites from several A. fœtidæ, mixed with corn meal and milk. Repeated the feeding on December 16th, December 29th and April 16th, 1907. May 25th, mouse with contracted hind leg died today. On examination I find loss of hair and a rough thickened skin on the back where the injection was made; the left hind leg anchylosed at the hip joint and a well marked tumor at the base of the penis. Sections from the skin on the back and from the tumor, show cancer cells. There was also a nodule under the skin of the right fore leg, which on section proved to be Cancer. One of the remaining mice died July 26th, and the last September 2nd. No tumors found. One of these had a tumor, but it disappeared and the mouse showed no signs of it when he died.

EXPERIMENT No. 40

On August 12th, 1906, injected under the skin, in front of the tail, six mice in cage No. 2, with parasites from A. fœtidæ. On September 9th repeated the injection in four of the mice. One of them has a small tumor where the first injection was made, so he was not disturbed. October 14th, injected five mice with a number of drops of a liquid made by cutting up a piece of cabbage leaf, which I had infected over one month before, with the parasites from A. fœtida. This leaf was dried several days and then broken and cut up in a glass dish with a little water, twenty hours before being used. It contained plenty of parasites, which were moving about. One of the mice in this cage was not injected, for he is well infected, having one hind leg anchylosed at the hip joint and a large surface from which the hair has disappeared, leaving the skin red, swollen and ulcerated. About three weeks after the first injection a small tumor appeared where this was given. November 27th, killed this mouse and found the parasites of Carcinoma in the lesion on the thigh, and genital organs. November 28th, fed the mice parasites from several A. fœtidæ, in corn meal and milk. December 7th, mouse No. 2 died today. On examination I found a bi-lobed tumor in the abdomen. It grew from and involved the rectum. It is a hard white tumor, degenerated internally, but in its outer circumference many cancer cells are found. December 10th fed the mice parasites as before and repeated the feeding on December 29th. March 16th, 1907, found one of the mice, No. 3, was dead. This mouse has had for six or seven weeks a growth involving the penis. It has grown very slowly. On opening the abdomen I found a nodule the size of a small pea, only irregular in shape. It was in the pelvic cavity and around the urethra, whose passage was blocked so no urine could pass. The bladder was dilated to its fullest extent, passing up into the abdominal cavity. There was also a hydatid cyst in the liver. Sections of the tumor, within and without the pelvic cavity, show it to be a new growth and clearly Carcinoma.

One of the other mice had a tumor in the abdominal wall, which grew for several weeks, but on March 25th I noticed it was smaller, and it continued to diminish in size, so that soon after April 10th it had disappeared. April 16th repeated the feeding. April 30th mouse No. 4 four died this morning. For several hours before he died there was a discharge of pus and blood from his bowels. Examination disclosed a tumor on the right side of the pelvic cavity extending to and involving the rectum.

Sections from this tumor show it to be Carcinoma. May 21st mouse No. 5 died today. I found two small nodules in the pelvic cavity, which I removed together with the rectum. One of them showed cancer cells, as also did the rectum. June 7th mouse No. 6 died today. Found a tumor in the pelvic cavity, which had been causing a hemorrhage from the bowels. This tumor was mostly degenerated, but in the outer parts of it I found Cancer cells. June 25th repeated the feeding of the mice as before. July 16th mouse No. 7 died today. On examination I find nothing abnormal except a large echinococcus cyst in the liver, which may have caused death.

October 3rd, mouse No. 8 died today. I found a large echinococcus cyst in the liver, and also a portion of diseased skin on the back and a small nodule in the intestine, both of which showed the parasites of Carcinoma. December 3rd fed the four mice remaining in the cage the organisms from A. fœtida. February 24th, 1908, killed the mice. The examination of three of them was negative. The fourth one, mouse No. 9, had a nodule with an open ulcer on his left fore leg near the body. It had been growing for several weeks. Sections from this clearly showed it to be Carcinoma.

EXPERIMENT No. 41

On August 12th, 1906, I injected under the skin of the back of six mice in cage 3 some of the parasites from A. fœtida, which had been boiled in a test tube with distilled water one hour. I had previously determined that one hour's boiling did not seem to kill them. They had every appearance of being alive, and they moved about about on the bottom of a watch glass many days after the boiling.

The importance of this experiment will readily be seen, for if boiling one hour does not kill these parasites then vegetables, which contain them, even though boiled, could not be eaten without danger of infection. September 15th one of the mice died today. No tumors found. September 19th discovered well-marked tumors in two of the mice. They were under the skin where the injection was made.

October 28th I injected the mice which were not infected before with the parasites from A. fœtida, which had been boiled one hour. November 28th fed the mice the parasites from A. fœtida by putting them in cornmeal and milk. They had been boiled one hour. December 16th repeated the feeding. The tumors under the skin in the two mice have disappeared. Repeated the feeding on December 29th and January 12th, 1907.

In addition to the five old mice there are now twelve young ones in the cage. March 25th one of the mice, No. 2, died last night. No tumors discovered, but some of the parasites were found in sections. May 17th mouse No. 3 died today. This mouse had a small tumor in the abdomen, which showed the Cancer parasites. May 29th, mouse No. 4 died today. No tumors found. June 8th mouse No. 5 died today. The skin of the back where the injection was made was thoroughly diseased. In this were found numerous alveoli containing well-marked Cancer cells. June 27th mouse No. 6 died today. There was a white nodule in the liver, which contained Cancer cells. July 1st mouse No. 7 died. The skin of the back where the injection was made was extensively diseased and contained Cancer cells. July 21st mouse No. 8 died. Found the skin thickened and diseased on the back where the injection was given. This condition extended down the hind legs. Sections from these parts showed Cancer cells. Mouse No. 9 died July 26th. Found well-marked Cancer cells in the diseased portion of the back where the injection was made. August 26th mouse No. 10 died today. For a few days before death the respiration was accompanied by a squeaking sound. On examination I found a greatly enlarged thyroid gland, which pressed against the trachea. In this gland and also in the liver many Plimmer's parasites were found. No tumors could be discovered.

Mouse No. 11 died October 20th, no tumors, but parasites found in different organs. December 5th mouse No. 12 died. No tumors found. The balance of the mice in the cage, numbers 13, 14, 15, 16 and 17 were killed February 24th, and contained no tumors.

EXPERIMENT No. 42

On August 28th, 1906, I injected under the skin of the back of six white mice in cage No. 4 the parasites from a large L. herculeus. September 23d found one of the mice dead. No tumors discovered. October 14th I injected as before the parasites of L. herculeus from a cabbage leaf which had been infected one month. The green leaf was cut up finely in distilled water and left twenty hours before being injected. Under the microscope the organisms could be plainly seen. October 28th repeated the injection with the organisms from the worm. November 28th and December 16th fed the mice the organisms mixed with cornmeal and milk. December 27th mouse No. 2 dead. On examination I found the rectum closed by a growth and the bowel

above dilated to its fullest extent by fœces. Sections were made from this growth and submitted to a well-known pathologist, who pronounced it a tumor of the bowel, and he believed it to be of a Sarcomatous type. December 29th and January 12th, 1907, repeated the feeding as before. February 21st found one of the young mice, No. 3, dead. There was an irregular, ragged, white, bony growth in the pelvic cavity surrounded by an effusion of blood. Sections showed this to be Sarcoma.

March 4th found another young mouse, No. 4, dead. No tumors found. March 20th mouse No. 5 dead. No tumors found. April 18th repeated the feeding of the mice. May 13th mouse No. six dead. Found one of the abdominal glands infiltered with spindle celled Sarcoma. June 18th mouse No. 7 dead. This mouse before death passed considerable pus from the bowels. On examinations I found a well-marked Sarcomatous tumor in the pelvic cavity. July 18th repeated the feeding of the mice. July 25th mouse No. 8 dead. No tumors found. July 27th mouse No. 9 died today. There was a well-marked round and spindle celled Saracomatous tumor in the pelvic cavity. August 4th mouse No. ten died today. Left lung lighter colored than normal, dilated to its fullest extent and hardened. Cells of Sarcoma were found through its structure, also in the kidney. and a nodule in the abdomen. This is a well-marked case of Sarcoma. September 23d mouse No. 11 dead. No tumors found. December 23d mouse No. 12 died today. Found a small tumor of the duodenum which was a Sarcoma. February 14th mouse No. 13 died today. Removed a small nodule from the tail where I broke it down several weeks ago to see if the parasites would locate there after the injury. There were several alveoli of Sarcoma cells in this nodule. They were also found in the kidney and a small nodule of Sarcoma in the abdomen. The three nice remaining in this cage were killed February 24th and no tumors found.

EXPERIMENT No. 43

On November 4th, 1906, I injected the organisms from several A. fœtidæ under the skin of the back in six young mice in cage No. 5. On November 28th they were fed the parasites mixed with cornmeal and milk. Repeated the feeding on December 16th and December 29th. February 17th, 1907, I injected the parasites in water into the peritoneal cavity . April 16th repeated the feeding as before. April 17th one of the mice dead. No tumors found. May 26th mouse No. 2 dead. The skin of

the back where the injection was made was rough, thickened and partly devoid of hair. Sections made from this showed well-marked Cancer cells. June 2d mouse No. 3 died last night. No tumors found. June 25th repeated the feeding of parasites. October 13th mouse No. 4 died today. No tumors found. January 16th, 1908, mouse No. 5 died today. No tumors found. February 10th mouse No. 6 died today. No tumors.

EXPERIMENT No. 44

On November 11th, 1906, I injected the parasites from several A. fœtidæ under the skin of the back of six young mice in cage No. 6. November 28th fed them the parasites in cornmeal and milk. Repeated the feeding December 16th and December 29th. On February 17th, 1907, injected the parasites into the peritoneal cavity. February 18th one of the mice dead. No tumors. Presumably died from injury during the injection.

April 3d mouse No. 2 dead. No tumors. April 4th mouse No. 3 dead. No tumors found. April 5th mouse No. 4 dead. No tumors. April 16th and June 25th repeated the feeding of A. fœtida. December 2d mouse No. 5 died today. No tumors. February 2d, 1908, mouse No. 6, last one in the cage, died today and no tumors found.

EXPERIMENT No. 45

On November 28th, 1906, I fed seven mice in Cage No. 7 the parasites prepared in the usual way from A. profuga. Repeated the feeding on December 16th, January 3d, 1907, and January 12th. On March 3d I injected the parasites of A. profuga into the peritoneal cavity of the seven mice.

March 27th mouse No. 1 died. The rectum was occluded by a growth and the large intestine was greatly distended with fœces. The large lobe of the liver was much lighter colored than normal and also greatly hardened. On section the epithelial cells of the rectum are found to contain many large oval-shaped cells of the parasites.

These parasites are much different from those of Carcinoma, or small, round and spindle celled Sarcoma. They are believed to be a species of Sarcoma. April 16th fed the six mice A. profuga as before. June 25th repeated the feeding of the mice, now fifteen in number. July 15th again fed them. August 25th mouse No. 2 died this morning. There was a nodule in the tail where I had broken it down several weeks ago to see if any of the parasites would locate at the injured part. That they did so was

evident from finding several alveoli containing them. The lung was also degenerated and contained cells of the parasite.

August 25th injected the parasites from A. profuga into the peritoneal cavity of twelve mice in this cage. Five of these mice died at different times, the remaining seven were killed February 24th. No tumors were found in any of them.

EXPERIMENT No. 46

On November 28th, 1906, fed twelve mice in cage No. 8 in the usual way parasites from A. fœtidæ. Repeated the feeding on December 16th and December 29th. February 17th, 1907, injected the parasites from A. fœtidæ into the peritoneal cavity of the twelve mice. February 18th one mouse died today. Supposed to have been injured in giving the injection. April 16th fed the mice in the usual manner the parasites from A. fœtidæ. June 14th mouse No. two died today. Right lung lighter color than normal, dilated and hardened. On section it is found degenerated and contains many of the parasites of Carcinoma. June 25th repeated the feeding of the mice. September 6th mouse No. three died today. I found a tumor in the abdomen, the inner portions of which were degenerated, but the outer circumference contained the cells of Carcinoma, as also did sections of the spleen.

September 18th mouse No. 4 died today. No tumors found, but plenty of the young parasites in the form of Plimmer's bodies in the stomach, liver and lungs. The liver, stomach, spleen and kidneys were thoroughly adherent to each other. October 30th mouse No. 5 died today. No tumors. A few of the parasites were found in the lungs, liver and kidney. November 5th mouse No. 6 died today. Found a well-marked tumor of the penis, which on examination proved to be Cancer, and Cancer cells were found also in the kidney, liver and lungs. November 15th mouse No. 7 died today. No tumors. November 17th mouse No. 8 dead. No tumors.

December 3d fed mice parasites from A. fœtidæ the usual way. December 7th mouse No. 9 died today. No tumors, only an echinococcus cyst of the liver found. December 25th mouse No. 10 died today. No tumors, only another echinococcus cyst of liver present. February 24th killed the two remaining mice in this cage. No tumors found.

The mice in cages 5, 6, 7, and 8 were young mice and these experiments plainly show that young mice are much less susceptible to malignant disease than those which are older. There is also another point worthy of notice—that is, that five of the

mice which were fed A. fœtida developed echinococcus cysts, showing that this species of earthworm is a bearer of this parasite. I have also observed the tænia echinococcus in sections of this worm. None of the animals fed other species of earthworms showed any signs of hydatid disease. I believe I have seen this spoken of elsewhere, but cannot recall where it was noted. It would seem to me quite probable that the earthworm may be one of the means of spreading the hydatid disease by taking in the parasite which has been deposited on the ground by the dog and other animals in their fœces and conveying it to grass and other vegetables upon which they are feeding. The herbivora and perhaps man would be infected if they ate these vegetables. Fowls and other birds would also contract the disease by eating earthworms containing the parasite.

EXPERIMENT No. 47

On October 17th, 1907, I injected into the peritoneal cavity of pig No. 1 new series. two hypodermic syringes full of a liquid made by boiling in distilled water in a test tube one hour, part of a cabbage leaf finely cut which was infected on July 23d, eighty-five days before, by smearing the under side of cabbage leaf growing in the garden with a liquid made by cutting up some A. fœtidæ in water. This leaf was boiled fourteen hours before using the liquid. Pig No. 2 received at the same time one syringe full of this liquid in the abdomen. October 21st No. 1 comatose this morning and died about 11 a. m. four days after the injection. Smears from the abdominal cavity stained with carbol-fuchsin and H. & E. showed plenty of the parasites in the ameboid form.

November 5th pig No. 2 died today, nineteen days after the injection. The parasites were found in sections of the organs and in smears from the abdominal cavity.

EXPERIMENT No. 48

On October 17th, 1907, I injected into the peritoneal cavity of pigs No. 3 and 4 one syringe full of a liquid made by boiling in distilled water in a test tube one hour, part of a cabbage leaf infected eighty-five days before by the parasites of L. hereculeus, as in the preceding experiment, and kept over night. Pig No. 3 died November 1st, fifteen days after injection. Pig No. 4 died October 31st, fourteen days after the injection. The parasites were found in both pigs in smears from the abdominal cavity and in sections of the different organs. They were in the ameboid form.

These experiments with these four pigs confirm *Experiment No.* 41, in which the mice in cage three were fed and injected with the parasites from A. fœtidæ which had been boiled in water one hour.

Together they furnish very strong evidence that it is unsafe to eat boiled vegetables, which contain the parasites of Cancer and Sarcoma.

EXPERIMENT No. 49

November 1st, 1907, fed pig No. 5 a dried cabbage leaf, some of the leaves of the cabbage of which had been infected fifty days before they were dried with the parasites from A. fœtidæ. These leaves had not themselves been directly infected, but were believed to contain the parasites carried into them by the circulation of the plant from other leaves which had been infected. November 10th and 11th repeated the feeding. Pig died December 3d, thirty-three days after the first feeding. No tumors found, but the ameboid forms of the parasite are seen in the blood and in sections of the lungs.

EXPERIMENT No. 50

November 1st, 1907, fed pig No. 6 a dried cabbage leaf, which was infected eighty-five days before it was picked by the parasites from L. hereculeus. This pig died November 9th, eight days after infection. No tumors, but parasites were found, especially in the lungs in the ameboid form.

EXPERIMENT No. 51

November 1st fed pig No. 7 a dried cabbage leaf infected eighty-five days before it was dried with the parasites from A. profuga. Pig died November 9th, eight days after infection. No tumors found, but the parasites in the ameboid form were present in different organs and in the blood.

EXPERIMENT No. 52

On July 23d, 1907, I cut into small pieces a number of A. fœtidæ after placing them in a small quantity of distilled water in a glass dish. I also did the same with a number of A. profuga and L. herculeus. Three young cabbages in the garden were marked by driving a piece of board into the ground by their side with the name of the worm used for infection upon it. Six leaves of one upon the under side were smeared with material

from A. fœtidæ, six of another with that of A. profuga and the same number of the third with material from L. herculeus. A colored string was tied loosely around the base of each of the leaves, so there could be no mistake in identifying them.

From fifty to eighty-five days after the treatment of the leaves, portions of them which plainly showed they were diseased, were removed, passed through alcohols of different strength, in the same manner as animal tissues and embedded in paraffin. Sections were made from these and stained with hæmatoxylin and eosin, carbol-fuchsin, polychrome methylene blue, thionin and Giemsa's stain. These showed plainly the parasites in the leaves. Some of these leaves were also placed in the stains while fresh left in them for twelve hours, and then passed through alcohol and embedded. Some of these leaves show the parasites in fair-sized ameba forms, others as very small nuclei scattered through the structure of the leaves. These are the leaves which contained the parasites which were used in the experiments on the animals just related.

DIAGNOSIS OF CANCER AND SARCOMA, BY THE EXAMINATION OF THE BLOOD

In many cases of internal tumors it is of vital importance to know whether they are of a malignant or benign nature. We believe that in all cases of advanced malignant disease and also in many cases in its incipient stage this can be determined by finding the parasites in the blood. The method is simple. A slight puncture of the finger or ear is made and a small portion of blood is put up in a cell with a little water. The cell is made with white zinc cement on a turn table and is sealed after the cover glass is put on with the same material. In this way the specimen is permanently preserved and can be examined at leisure. If the tumor is external it will be better to puncture it and take the blood directly from it for examination. In case the tumor has opened up the discharge from it had better be examined. In the case of a Sarcoma of the breast I put up some of the discharge which exuded from the open surface of the tumor, and in this I found some of the spore sacs of the parasite, which were exactly like those I have seen in the earthworm an hundred times. The young parasites extended from the external surface of the spore sac and were in active vibration, just as they are in the earthworm. Two hours afterward these were found thrown off and were lying around the spore sac. Photographs taken in both of these stages are shown in this paper and

afford convincing proof that the organism in malignant disease and that in the earthworm are one and the same. Moreover, it establishes another truth, and that is that there is a sexual stage through which the parasite is propagated in man. The parasite in the blood is generally seen in its round or ameboid form and resembles globules of fat. It is also found in the discharges from cancer in the form of spore sac's. We believe these organisms may be present in the blood of many persons for a long time and not develop into a tumor unless they sustain some injury or become weak and exhausted from some other disease. If they sustain an injury the blood vessels may be occluded at the part injured and the parasites being stopped here increase in the part and form a tumor. This we believe readily accounts for cancer of the cervix from lacerations, cancer of the rectum from irritation of hardened fœces, of the breast from external injuries and of the lip from smoking a pipe.

CANCER IN FISH

That fish may have cancer has been demonstrated by keeping them in an acquarium and feeding them earthworms. These fish generally died in from four to six weeks and the parasites of cancer were found throughout their organs. Whether there is any danger from eating fish or fowls which have fed upon earthworms is a point which has not been investigated. This subject is certainly worthy of attention.

THE MANNER IN WHICH CANCER AND SARCOMA ARE PROPAGATED

This is a very important question, for upon its solution depends all our efforts to prevent these terrible diseases.

The foregoing experiments have been conducted for the most part by taking the parasites directly from their Original Hosts and feeding them to or injecting them into the animals experimenting upon.

In some instances their intermediate Hosts, the leaves of vegetables and grass, have been used to infect animals, and the result has been the same. Poultry and birds of many kinds are apparently immune, for if they were not many species of these which feed on earthworms would soon become extinct. The reason for this immunity I have not investigated.

The result of our work shows that man and the herbivorous animals generally contract malignant disease from eating vegetables which are infected by earthworms crawling over them

and leaving the parasites of Cancer and Sarcoma upon their surface. These soon enter into the interior of the leaf, and when the infected vegetables are eaten the parasites are scattered through the system ready to enter on their work of destruction.

Our experiments also indicate that boiling the parasites, or vegetables containing them, one hour does not kill them. Further investigation along this line should be made on account of its great importance. It would seem reasonable that that the carnivorous animals contract malignant disease from eating dead animals, or meat lying upon, or in the ground which has been infected by earthworms, which have also been feeding upon it. We have cited authorities in the first part of this paper showing that earthworms are very fond of meat.

Description of the Hosts which Contain the Parasites, which Cause Carcinoma, Round and Spindle-Celled Sarcoma, and Another Parasite which Produces a Species of Sarcoma.

The group of animals to which these Hosts belong is called the Chætopoda or Bristle Worms. This group embraces four different orders, namely: the Archiannelida, Polychæta, Myzostomaria and the Oligochæta, which last named order contains the Hosts in which we are interested. The Oligochæta are divided into two groups, namely: Microdrila and Megadrila.

These comprise many families, and I find in F. E. Beddard's Monograph on the Oligochæta, published in 1895, that 667 species of these worms are recorded. Many others have since been identified and placed on record. All countries as far as known contain some species of these worms. Their habitat varies greatly; some are terrestrial, live in the soil, others flourish in fresh water lakes and rivers and still others are marine, living especially on the shores of the ocean.

It will thus be seen that the group of animals which harbor the parasites belonging to the family which produces Cancer and Sarcoma are everywhere present. They clearly account for the fact that the fish of the ocean and of fresh water lakes and rivers all fall victims to malignant disease.

The worms in which we are particularly interested belong to the group Megadrili and the family Lumbricidæ. This family contains three genera, namely: Allurus, Allolobophora and Lumbricus.

Our experiments were conducted with those belonging to Allolobophora and Lumbricus. The first contains Allolobophora fœtida, which we have found to be the Host of the parasite producing Carcinoma, and Allolobophora profuga the Host of a parasite which produces a disease belonging to the Sarcoma.

Lumbricus contains Lumbricus herculeus, which harbors the parasite which produces small round and spindle celled Sarcoma. These parasites have been used to infect animals many times, as before related in this paper, and when malignant tumors were produced they were of the type indicated above. I have never examined an earthworm which did not contain parasites belonging to this family, and it is not improbable none such are found. The description of the three earthworms with which the most of our experiments were made is taken from F. E. Beddard's Monograph, and is as follows:

ALLOLOBOPHORA FOETIDA

This worm is described as being ninety m.m. in length; breadth four m.m., number of segments 105. Clitellum XXV. XXVII-XXXII. Setæ, strictly paired. First dorsal pore, IV/V. Tubercula pubertatis XXVIII-XXXI. Spermathecæ, two pairs in IX, X opening posteriorly, very dorsal in position.

Habitat:—Europe, America, Asia, &c. (universally distributed). This species has a very characteristic coloration; the ground color is a flesh tint marked in each segment by a ring of purplish color.

They flourish abundantly in manure heaps and rich gardens, to which they are often conveyed by the manure used to enrich the soil.

This is the Host of the parasites which causes Carcinoma, and it is very significant that this is the only worm in the Monograph which is described as being *universally distributed.* This worm has a very strong, disagreeable odor which I believe is caused by the parasites and may account for the peculiar odor of Carcinoma.

LUMBRICUS HERCULEUS

This is the large earth worm which is commonly used in biological work, and is described as being 360 m m in length, number of segments 180. Clitellum XXXII—XXXVII, Tubercula pubertatis, XXXIII—XXXVI. First dorsal pore, VII/-VIII. Male pores conspicuous. Habitat: Northern Europe, North America, Siberia. This is the Host of small, round and spindle-celled Sarcoma.

ALLOLOBOPHORA PROFUGA

This species is very abundant in New York State and is generally larger than described by Beddard. It is the Host of a parasite which produces in animals a malignant growth belonging to the Sarcomatous group. Perhaps this is large, round-celled Sarcoma. It is described as follows:

Length about sixty mm (often double that length here). Diameter three mm. Number of segments 165. Clitellum XXX—XXXV. Tubercula pubertatis XXXI—XXXIV. Spermathecæ two pairs in X,XI, open in line with third setæ between IX/X, X/XI. First dorsal pore, X/XI. or XI/XII. Habitat: Italy, Germany, Spain, Argentine, and I will add America.

LIFE HISTORY OF THE PARASITES

These parasites belong to the lowest class in the Animal Kingdom, are composed of a single cell and known as the Protozoa. The Protozoa are found everywhere in nature, in the soil, fresh water lakes and rivers, and the ocean. They are divided into four groups: the Sarcodina, Mastigophora, Infusoria and Sporozoa. The parasites which we are now considering belong to a family heretofore undescribed in that large group, the Sporozoa. In Lankester's treatise on zoology I find it stated that "The Sporozoa are a group of exclusively parasitic Protozoa of very widespread occurrence, infesting the internal organs or tissues of animals belonging to almost all classes and orders of Celomate Metazoa. There is perhaps no species of annelid, mollusc, arthropod or vertebrate, which is not liable to be become the host of some kind of sporozoan parasite, at any rate, in certain localities, while many animals harbor several species of these intruders at the same time. Moreover, in some cases, as for instance, that of the common earthworm or the mealworm, scarcely an individual can be found which does not contain more or fewer of its particular form of sporozoan parasite." The life history of these parasites, like others of the sporozoa, is very complicated. Two methods of reproduction take place within the earthworm. The sexual and asexual. No other intermediate animal is necessary for the perpetuation of the species. Man and the various animals which they destroy are accidental Hosts—that is, they play no necessary part in the life history of these parasites or their dissemination. Their life cycle, like many of the Sporozoa, is digenetic—that is, it is differentiated into two distinct generations or stages of generation, the sexual and asexual, as stated above.

The asexual stage in the Sporozoa is generally said to be endogenous or self-infective and only serves to increase the number of parasites within its Host. The sexual or exogenous stage usually serves to spread the infection amongst new hosts. From my observation on these Parasites of the earthworm I believe they differ in one respect from some of the other sporozoa. This is in regard to the endogenous method of reproduction. From my study of this stage it seems highly probable that it not only serves as a method of self-infection, but also of disseminating the parasites and spreading them abroad to infect other animals and plants.

The life history of these parasites as I have worked it out is as follows: The earthworm takes in the parasite in its food, it passes into the intestinal canal where it is seen in a round or oval form, containing several small nuclei. From here it enters into the intestinal epithelial cells, where it becomes elongated to adapt itself to the cell. It passes through these epithelial cells, the vascular layer, circular and longitudinal muscles into the outer layer of cells surrounding the intestine which is represented by the peritoneal epithelium. When it arrives here the nuclei have undergone fragmentation into many minute round cells, which distending the peritoneal epithelium have been known as the chlorogogue or chlorogogen layer.

The parasite as it is taken into the intestinal canal is called a Sporozoite. When it enters the intestinal epithelium it absorbs nourishment from its host and grows rapidly. This is called the tropic stage and the parasite a trophozoite. After completing its passage through the intestinal wall into the peritoneal epithelium division of the nuclei, or fragmentation having taken place just before it reaches the peritoneal cavity, it is composed of many very small cells. This process, which is called schizogony, leads to the increase of parasites within the host.

The result of my investigation of the small cells which form the chlorogogen layer leads me to believe there are two ways, in either one of which their further development may take place.

FIRST: Some of these very small cells are surrounded by a layer of protoplasm. They increase in size, division of the nucleus takes place and they form what has been called a merozoit—very similar to the sporozoits. These pass through the body cavity of the earthworm, increasing the number of parasites within the host.

I believe they also pass out through the orifices of the skin of the earthworm and are distributed wherever the earthworm happens to be.

IN THE SECOND PLACE: Some of these cells pass along the celiac cavity of the earthworm until they arrive in the seminal vesicles. Here seems to be the natural place for their sexual development. Some of these sexual cells (or gametes as they are called) increase in size and develop into the female cell or macrogamete, others into the male cell or microgamete. The female cell develops and a prouncleus is formed which approaches the surface of the cell, which often becomes somewhat drawn out or pointed at this place. The male gametes each develop a large number of microgametes, which before they become free project from the circular sperm sac of the microgamete and are seen to be in constant vibration. When they become free they seek out and unite with the pronucleus of the female cell. The result of this union is the formation of sporozoites.

The number of spororoites resulting from the union of a male and female cell is eight (8) and its multiples sixteen—thirty-two (16—32) &c. The seminal vesicles of the earthworm are seen to be filled with these parasites in the different stages of their sexual development. I believe the sporozoites here, like the merozoites before described, pass out through the orifices in the skin and are distributed by the earthworm along its path. There is another point here which is worthy of notice. That is that what has for many years been taken and accepted as spermatozoa of the earthworm itself in what has been called the seminal vesicles is nothing more or less than the microgametes or male elements of this parasite.

WHY IS CANCER INCREASING SO RAPIDLY AS STATISTICS SEEM TO PROVE?

The reasons for this are two-fold. *FIRST*: Earthworms are very much more abundant in old countries which have been settled for a long time. They seem to increase in the soil which is under cultivation. *SECOND*: The greater amount of vegetables, such as cabbage, lettuce, celery, etc., which are eaten at the present time and which we have proved contain the parasites, causing this disease.

MEANS OF PREVENTING CANCER AND SARCOMA

The greatest benefit to be derived from the study of medicine is the prevention of disease. When we know its origin and cause, as in the present case, our chances for preventing it are vastly increased. I believe the evidence I have presented shows

very clearly that the parasites of malignant disease live in different species of the earthworm and are conveyed to man and animals through the vegetables they eat which are infected by these parasites. Must we, then, stop eating such kinds of vegetables in order to obtain immunity? Not necessarily. There are some parts of the country where the soil is dry and sandy, as in Florida, where earthworms are rarely found. Vegetables growing in these places would stand small chances of being infected. I wish here to state two propositions which I believe will be found to be correct: *No earthworms, no cancer. Plenty of earthworms, plenty of cancer.* To show these propositions are correct I find in the third census of the State of Florida taken in the year 1905 that there are forty-six counties in that State. Twenty-four of these counties with a population of 208,733 had a mortality of 807. None of these deaths were from cancer. In the remaining counties there were sixty-six deaths from cancer. How many of these, if any, had been permanent residents of Florida I do not know. Many go down there to live from the Northern States and may have been infected before they went there. I have talked with some of the old physicians of Florida, who claimed they had never known in their practice any of the permanent inhabitants of Florida to have cancer. It is certainly very uncommon in that State. Compare this with the mortality in Western New York where earthworms are plenty. In the census of 1907 in Buffalo one death in twenty-one was from cancer. In Rochester one out of eighteen died from this disease. Jamestown one in fifteen. Ithaca one in fourteen.

There is also another way to prevent malignant disease, although this involves a great amount of labor. It is to destroy the earthworms in the soil and the vegetables growing where this is done will be free from the parasites. This can be accomplished in small gardens without very much outlay, but large fields would of course involve greater labor.

In my work on the "Gape Worm of Fowls" I made a series of experiments in regard to the destruction of earthworms in the soil. In these experiments three (3) different substances were employed, namely: Lime, common salt (chloride of sodium) and wood ashes. The experiments which are applicable here are as follows:

EXPERIMENT No. 1

An earthworm just dug and with the dirt still adhering to it was thrown into dry lime which had been slacked for several

weeks. At the end of twelve minutes it was dead. Doubtless fresh lime would have killed it much quicker.

EXPERIMENT No. 2

An earthworm was thrown into lime water. In seven minutes it ceased to move.

EXPERIMENT No. 3

An earthworm was placed in a solution of common salt having the strength of one-fourth pound to the gallon of water. In six minutes it was dead.

EXPERIMENT No. 4

An earthworm placed in salt solution of the strength of one pound to the gallon of water lived three minutes.

EXPERIMENT No. 5

An earthworm thrown on dry salt ceased to move in somewhat less than three minutes.

EXPERIMENT No. 6

An earthworm thrown on dry wood ashes lived about twelve (12) minutes.

EXPERIMENT No. 7

An earthworm placed in lye made by pouring warm water on wood ashes and letting it stand one hour, the proportion being one-half pound of ashes to one gallon of water. The earthworm ceased to move in three minutes.

It is thus seen that lime, salt and ashes are all effective in destroying the earthworm. They can be spread over the ground or used in solution. If only a small plot of ground is to be treated a solution of salt, of one or two pounds to the gallon of water, can be sprinkled over the surface in sufficient quantity so it will penetrate some distance below. The earthworms which come in contact with the solution will immediately come to the surface and die.

I will recapitulate the various points I believe are established in this investigation:

FIRST. That malignant diseases are caused by different species of *parasites* heretofore unknown and belonging probably to the sporozoa.

SECOND. That the earth worm is the Original Host of the parasites which produce malignant tumors.

THIRD. That the earthworm Allolobophora fœtida is the host of the parasite which produces Carcinoma.

FOURTH. That the earthworm Lumbricus herculeus is the host of the parasite which produces small, round and spindle-celled Sarcoma.

FIFTH. That Allolobophora profuga and probably other kinds of earthworms contain different species of parasites belonging to the same family and perhaps produce other varieties of malignant disease.

SIXTH. That the intermediate hosts of these parasites are various kinds of vegetables, the leaves of which are infected by earthworms crawling over their surface when feeding upon them. I would say here it is *possible* that the parasites may also be taken from the ground into the circulation of the plants through their roots.

SEVENTH. That man and the herbivorous animals contract malignant disease by eating these infected vegetables.

EIGHTH. It is probable that carnivorous animals contract malignant disease by eating dead animals, or meat lying upon, or in the ground which has been infected by earthworms crawling over them. The above points, except the last, have been proven by experiments on many animals in which malignant tumors were produced.

NINTH. That boiling these parasites or the vegetables containing them one hour does not kill the spores and therefore it is unsafe to use boiled vegetables which are infected by these parasites.

TENTH. That in those portions of the country where earthworms are rarely found the permanent inhabitants rarely or never have cancer.

ELEVENTH. That *lime, salt, or wood ashes* can be used to destroy the earthworm and thus prevent the infection of vegetables, through the eating of which *Cancer* and *Sarcoma* are produced.

EXPERIMENTS MADE FOR THE PURPOSE OF FINDING A CURE FOR MALIGNANT DISEASE

After a long series of experiments upon the parasites in the earthworm with different compounds, I finally discovered a preparation which readily kills these parasites, as demonstrated under the microscope, and can be taken by persons without

injury and I believe this passes into the blood when taken internally. Experiments are now being made on 156 persons suffering with cancer and sarcoma and they show the curative effects of this remedy in many of these cases. Cancerous tumors of years standing, are passing away; the sharp, lancinating pains are disappearing; the sleep is improving, and their general health is much better. Not one of the cases applying for treatment, even the most hopeless, has been refused. As a consequence of this a number of deaths have occurred, some within forty-eight hours, others at a longer period after beginning the use of the medicine. Several of these were from complications which arose during the progress of the cancer. The subjects of cancer, when the patient knows the disease he is afflicted with, are often in a most deplorable state of mind, for cancer is generally believed to mean sure death to the one who has it, at no very distant period. For this reason, when I see any chance for the patient's recovery, I have encouraged them to hope for the best and have given them a short history of cases that seemed hopeless, but were improving under treatment. This places the patient's mind, and through their mind the body, in much better condition to digest and assimilate their food and to promote rest of body and mind. This psychotherapy, as it may be called, has been used by every intelligent physician from time immemorial in an indirect way, perhaps, but has of late years been brought more prominently before the profession. That it has a beneficial effect upon the patient there can be no doubt, but it is incredible that it could have any direct effect in the removal of cancerous tumors. It is too early to say anything definite as to a permanent cure, for it is only in its experimental stage, but the outlook is very promising.

CONCLUSION

In view of the terrible loss of life and suffering caused by malignant disease, I deem it my duty to present this paper to the medical profession, so they may take up the work and give their verdict upon it.

If I am correct, all this suffering and death can be entirely prevented by refraining from eating vegetables, such as *cabbage, celery, lettuce, onions,* &c., or whatever else may hereafter be found to be infected by these parasites.

ILLUSTRATIONS

SHOWING THE ORIGINAL HOSTS OF THE PARASITES WHICH PRODUCE CANCER AND SARCOMA. ALSO THE PARASITES THEMSELVES AND THE TUMORS THEY PRODUCE.

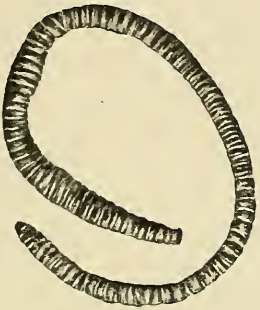


Figure No. 1

Allolobophora foetida. The Earthworm which contains the parasites which cause Carcinoma.

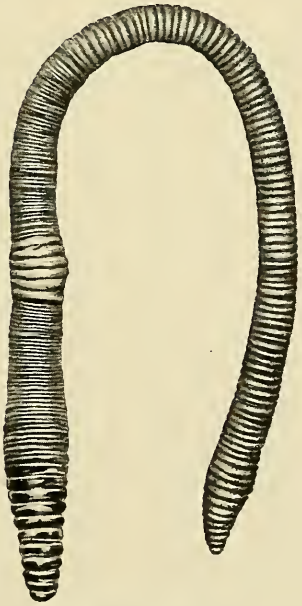


Figure No. 2

Lumbricus herculeus. The Earthworm which contains the parasites which cause small round and Spindle-celled Sarcoma.

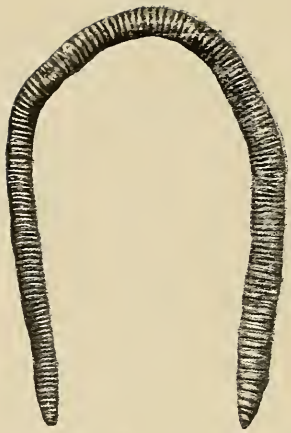


Figure No. 3

Allolobophora profuga. The Earthworm which contains parasites which cause malignant tumors believed to belong to the Sarcoma,—perhaps large round celled Sarcoma.

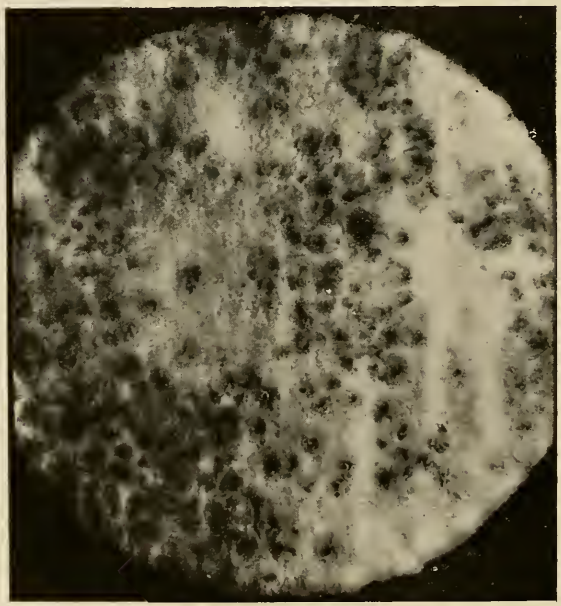
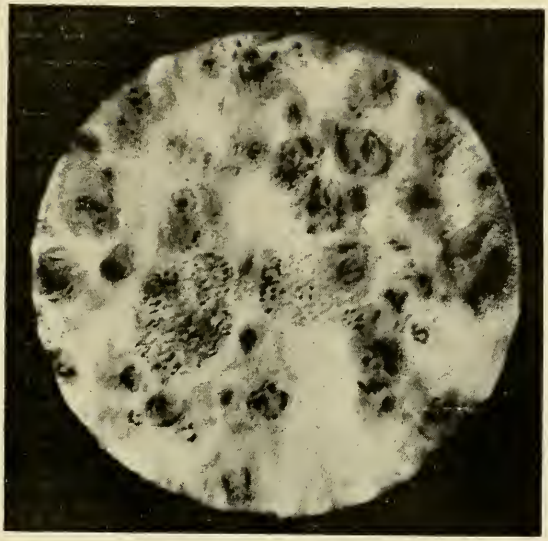


Figure No. 4

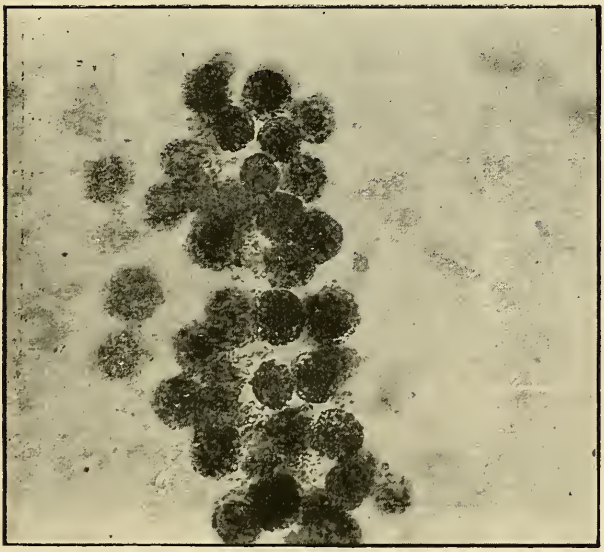
Parasites of Carcinoma from A. foetida. Stain H. and E. 500 diameters.

Figure No. 5



Parasites of Round and Spindle-celled Sarcoma from L. herculeus. Stain H. and E. 500 diameters.

Figure No. 6



Parasites from A. profuga, believed to be the cause of a species of Sarcoma. Stain H. and E. 500 diameters.

Figure No. 7

Section of Seminal vesicle of L. herculeus showing parasites in Sexual Stage. Stain H. and E. 200 diameters.

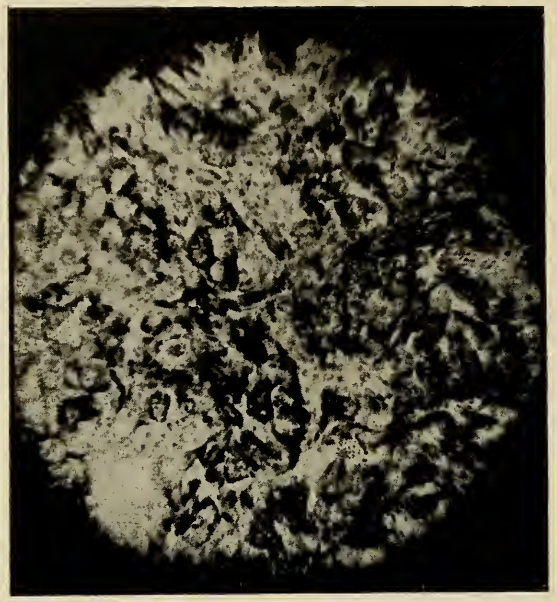


Figure No. 8

Transverse Section of Lumbricus herculeus showing parasites passing through the epithelial cells of the intestine into the celom. On the outer surface of the intestine are seen the small cells of the parasites after Schizogony has taken place and they have passed through the intestinal wall. These merozoites are collected in masses here and this is what has been called the chlorogogue layer. Outside of there masses of cells are seen, many cells of the parasite in which considerable development has taken place. H. and E. 200 diameters.

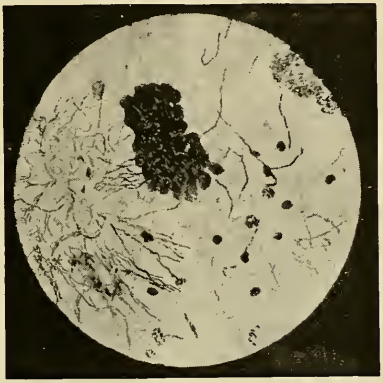


Figure No. 9

Parasites from Smear of A. foetida, Sexual Stage showing Microgametes. Macrogametes and cluster of Sporozoites in process of development. Stain H. and E. 375 diameters.

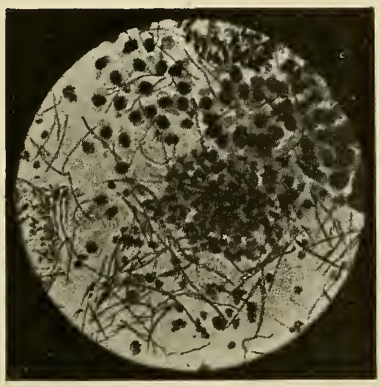


Figure No. 10

Parasites from Smear of L. herculeus Sexual Stage showing Microgametes, Macrogametes and Sporozoites. Stain H. and E. 375 diameters.

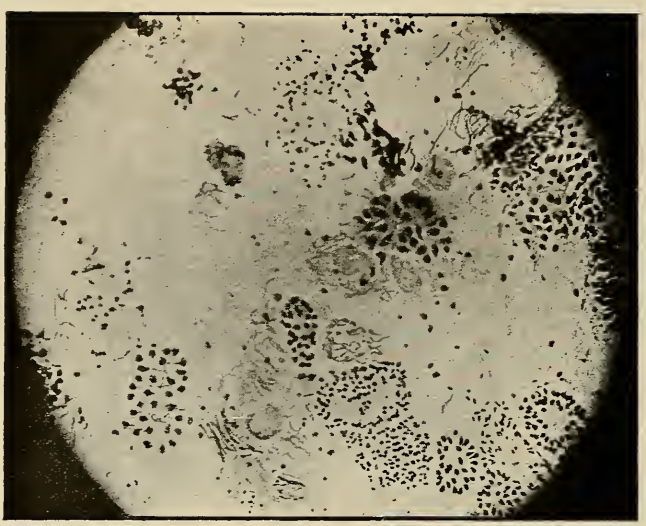


Figure No. 11

Parasites from smear of L. hercules Sexual Stage Showing Microgametes. Macrogametes and Sporozoites in different stages of development. Stain H. and E, 220 diameters.

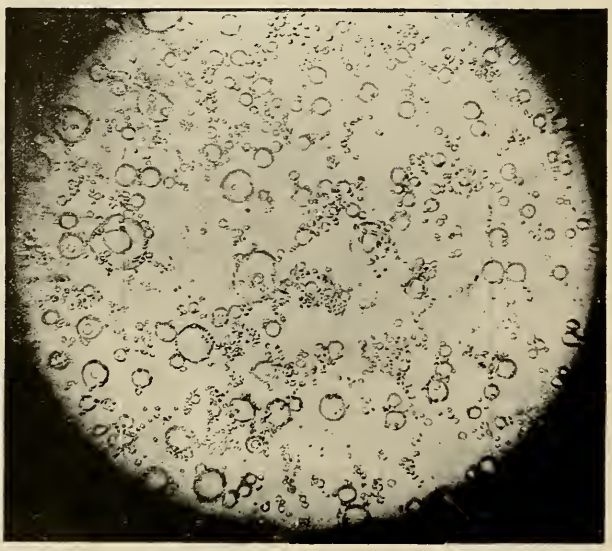


Figure No. 12

Culture of parasites of A. fœtida in cell with water and pieces of grass taken five years and seven months after being put up. Note division and endogenous cell formation. 200 diameters.

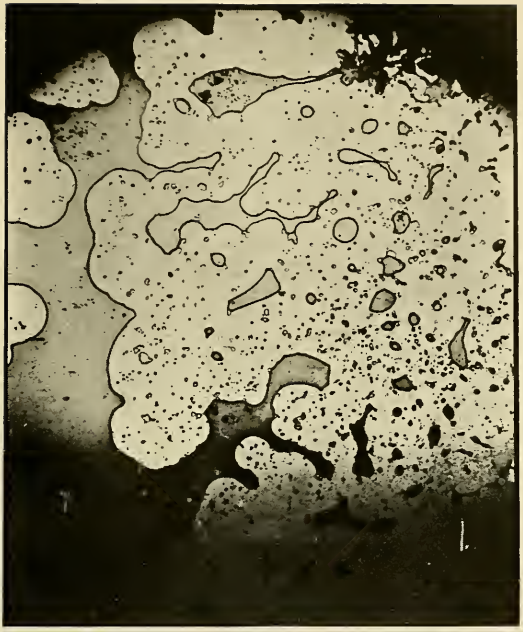
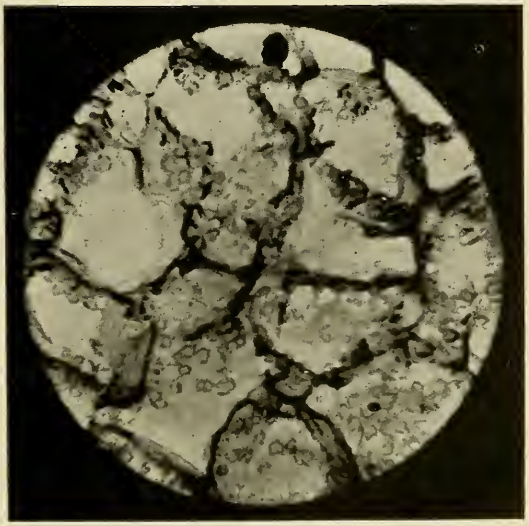


Figure No. 13

Parasites of A. fœtida from cabbage leaf infected by smearing under side of leaf with the worms cut up in water. This growing cabbage leaf was left fifty days then picked and well washed, cut up in water and boiled in a test tube one hour. Some of this liquid was put up in a cell and after 325 days photograph taken showing the parasites in ameboid and round forms. 15 diameters.

Figure No. 14



Cabbage leaf infected by A. fœtida fifty days. Sections from leaf stained with polychrome methylene blue and photograph taken showing parasites. 500 diameters.

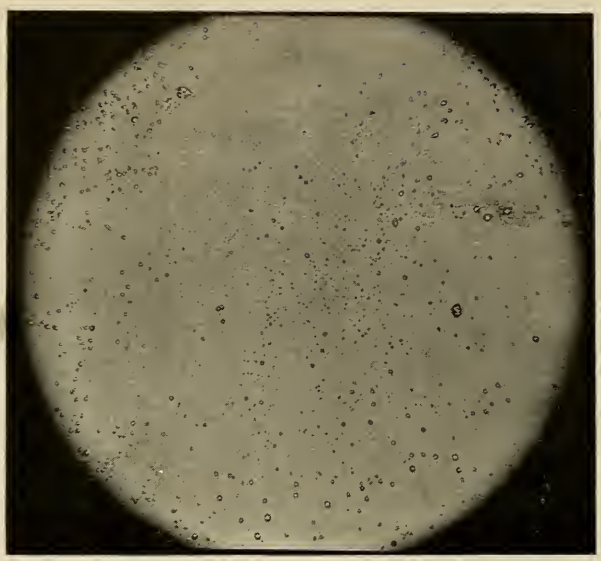


Figure No. 15

Parasites of L. herculeus from infected cabbage leaf after eighty-five days. Cabbage leaf boiled one hour and liquid put in cell in slide and photograph taken after being in slide 210 days. 200 diameters.

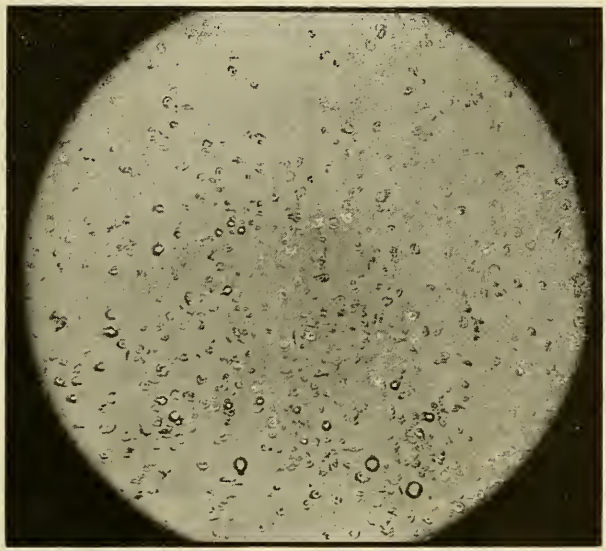
Figure No. 16

Scrapings of cancer put up in cell with water and photographed. Parasites in round and ameboid forms. 200 diameters.

Figure No. 17

Parasites from cancer of breast kept at 110° Fahr for twenty-four hours then put up in a cell with water and photographed after six years. Note endogenous cell formation. 200 diameters.

Figure No. 18

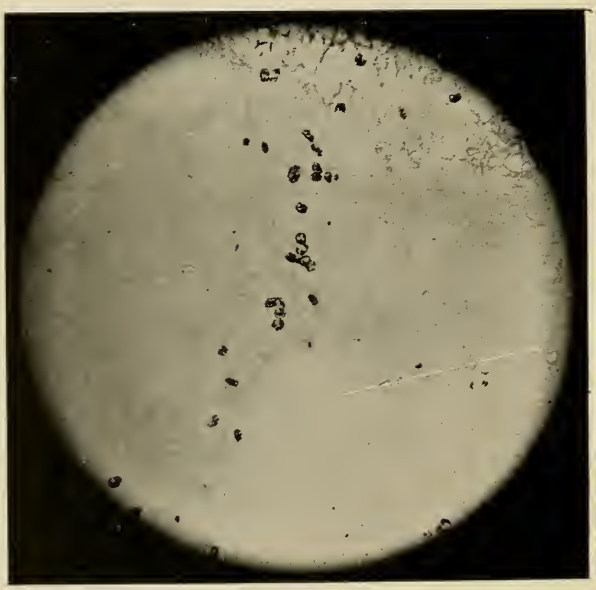


Parasites from blood of ear of Pig 25 eighteen days before he was killed. This pig was infected by parasites from A. fœtida and then fed green grass which seemed to render him immune. 200 diameters.

Figure No. 19

Smear from abdominal cavity of Pig 1, Series 2. Pig died four days after receiving one dram of liquid from a cabbage leaf cut up in water. This cabbage leaf had been infected with parasites from A. fœtida eighty-five days before being used and was boiled one hour before injection. Parasites in ameboid form. Stain carbol-fuchsin. 200 diameters.

Figure No. 20



Smear from abdominal cavity of pig 4, Series 2. Pig died fourteen days after receiving one-half dram of liquid from a cabbage leaf cut up in water. This cabbage leaf had been infected with parasites from L herculeus eighty-five days before being used and was boiled one hour before injection. Parasites in ameboid form. Stain carbol-fuchsin. 200 diameters

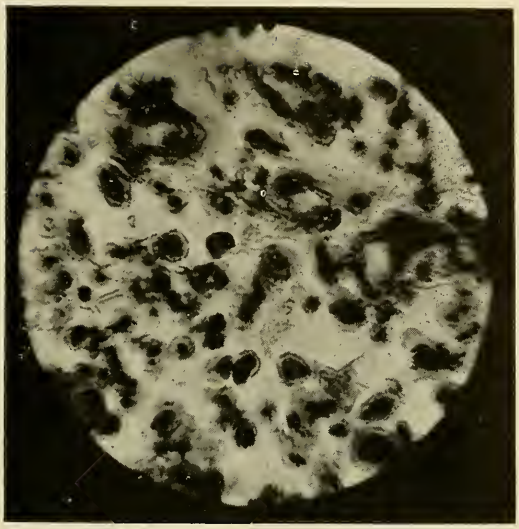


Figure No. 21

Parasites from tumor under skin of Dog 3, sixty-five days after injecting parasites from A. fœtida under the skin where the tumor was formed. Stain H. and E. 500 diameters.

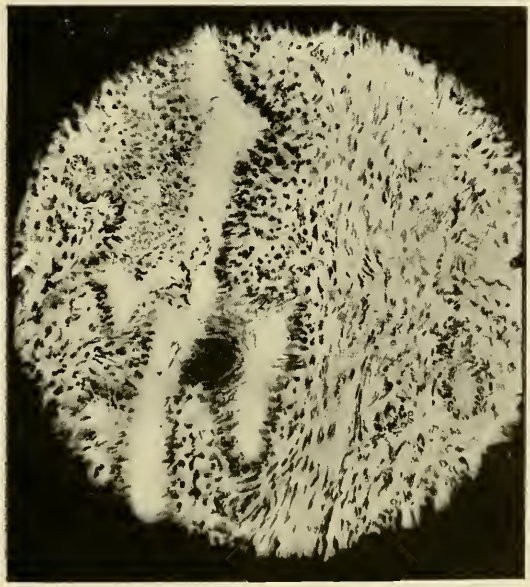


Figure No. 22

Section from tumor of liver of Hare 5. Adeno-Sarcoma. Stain H. and E. 200 diameters.

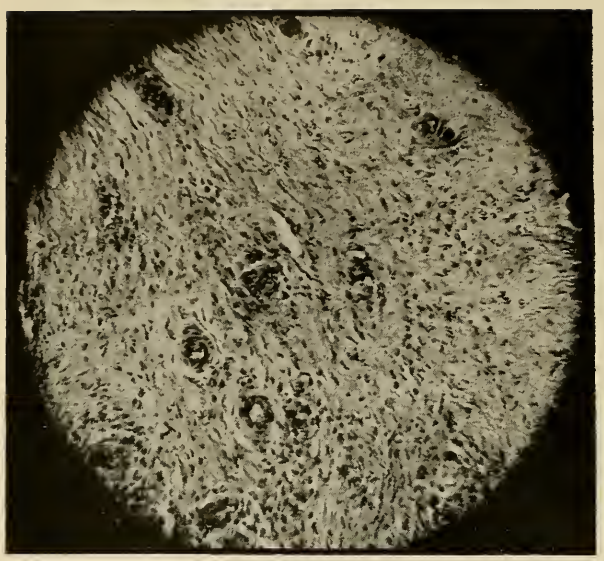


Figure No. 23

Section from tumor of peritoneum Hare 11. Carcinoma. Stain H. and E. 200 diameters.

Figure No. 24

Tumor of the rectum in mouse 2 cage 2. This was a bilobed tumor which obstructed the rectum and killed the mouse which was infected by the parasites from A. foetida, Carcinoma. Stain H. and E. 200 diameters.

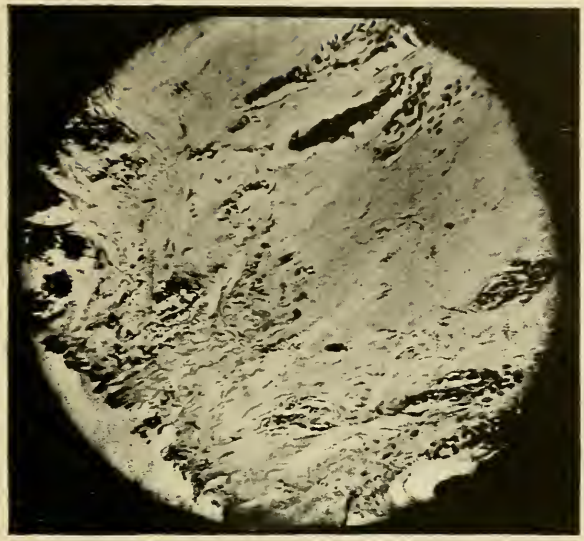
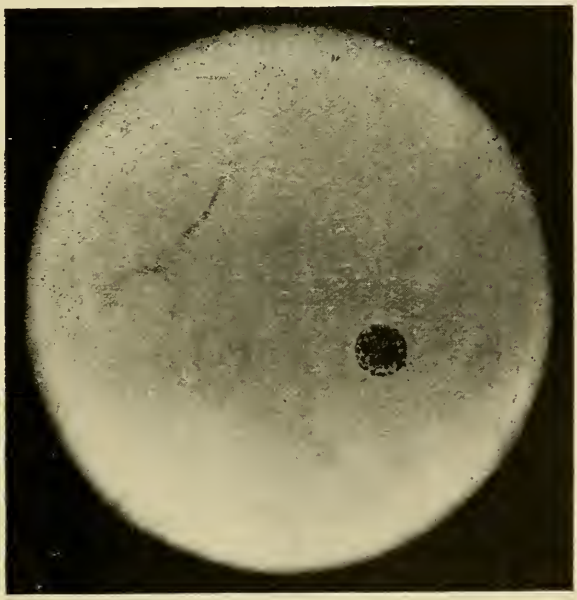


Figure No. 25

Carcinoma of skin of back of Mouse 9 cage three. This mouse was infected by parasites from A. foetida which had been boiled one hour. H. and E. 200 diameters.

Figure No. 26



Spore cyst from the discharge in a case of Sarcoma of the breast. Spores around the surface of cyst were in active vibration. I have seen them exactly like this one in the Earthworm many times. 200 diameters.

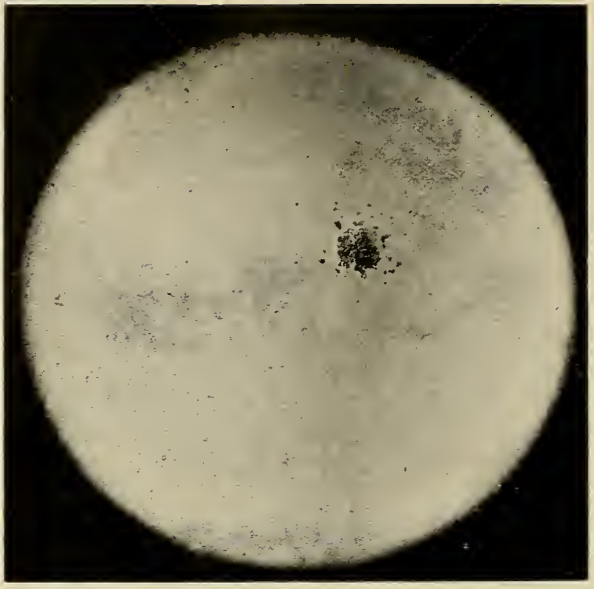


Figure No. 27

Spore cyst in Figure No. 26 taken two hours afterwards. The position of the spore cyst was not changed under the microscope and the photograph shows many of the spores liberated from the cyst. They are in the ameba form. These photographs were taken May 18th, 1909. At this date September 18th, 1909, four months afterward the ameba are seen around the cyst-and they have increased greatly in size, some of them being five or six times as large as when the photographs were taken. 200 diameters.

Figure No. 28

Ameba form of parasite from the blood of finger of a woman who has had cancer for the six years. This is the largest ameba form I have ever seen in the blood. Note the budding process taking place. 200 diameters.

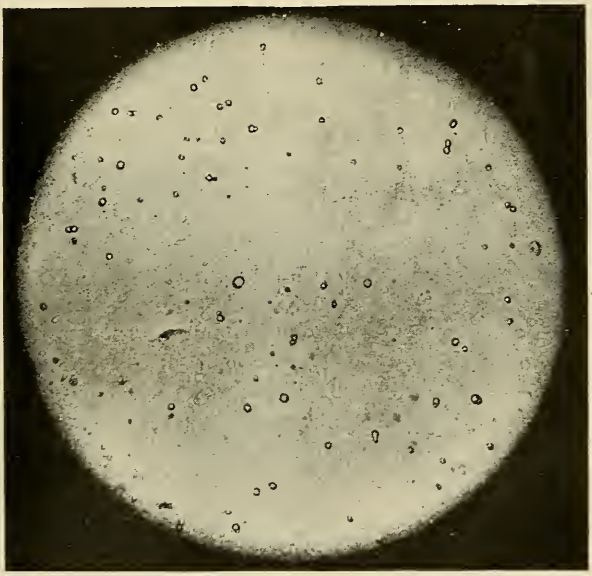


Figure No. 29

Parasites from blood of case of epithelioma of lip of two years duration. The blood was taken directly from the tumor. Note several of the cells of the parasites are dividing.

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